



Current research and future plans

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S&T Review: break-out session

Quark and gluon degrees of freedom

- low x-section ϕ and Ωv_2
→ *reduced dependence on hadronic stage*
- constituent quark systematics

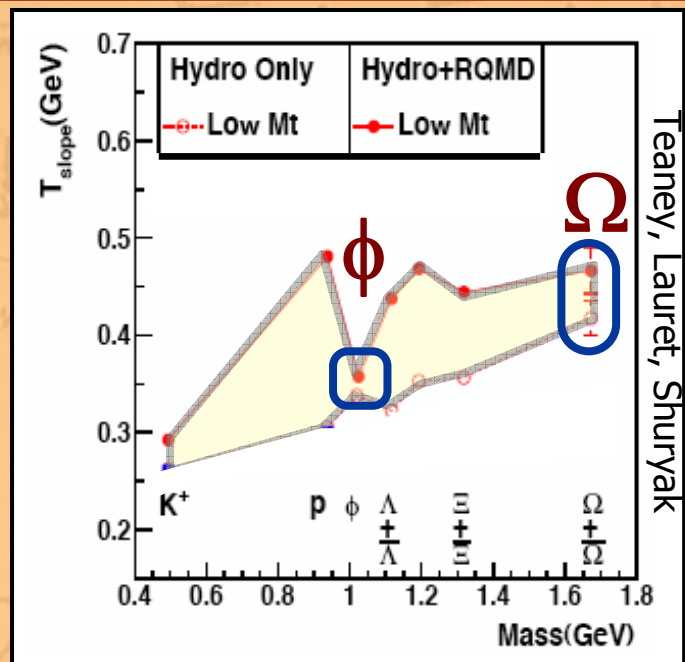
□ Elliptic flow fluctuations

- constrain the initial conditions
→ *CGC or Glauber initialization of hydro*
- reduce $\langle v_2 \rangle$ uncertainties

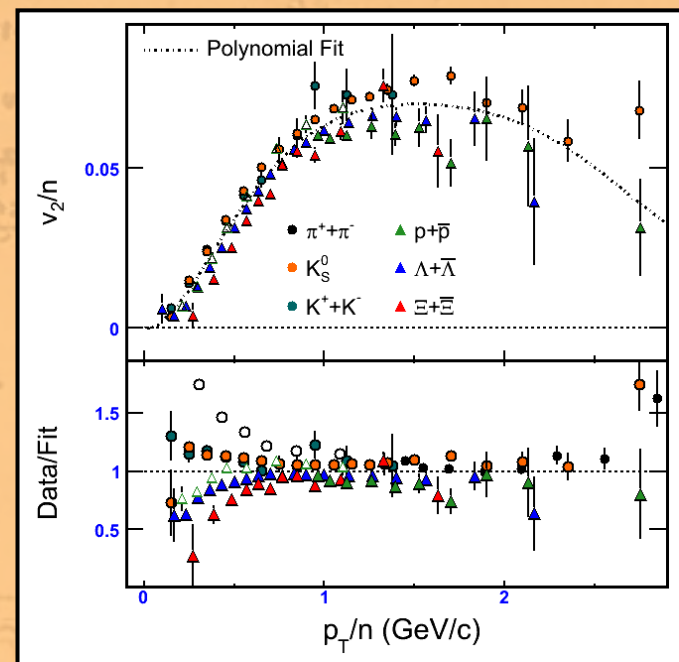
Disappearance of quark and gluon dof and/or critical point discovery

- high μ_B low $\sqrt{s_{NN}}$ RHIC scan

objectives



ϕ and Ω have real sensitivity to the EOS



v_2 scales with number of const. quarks: reveals sub-hadronic d.o.f.

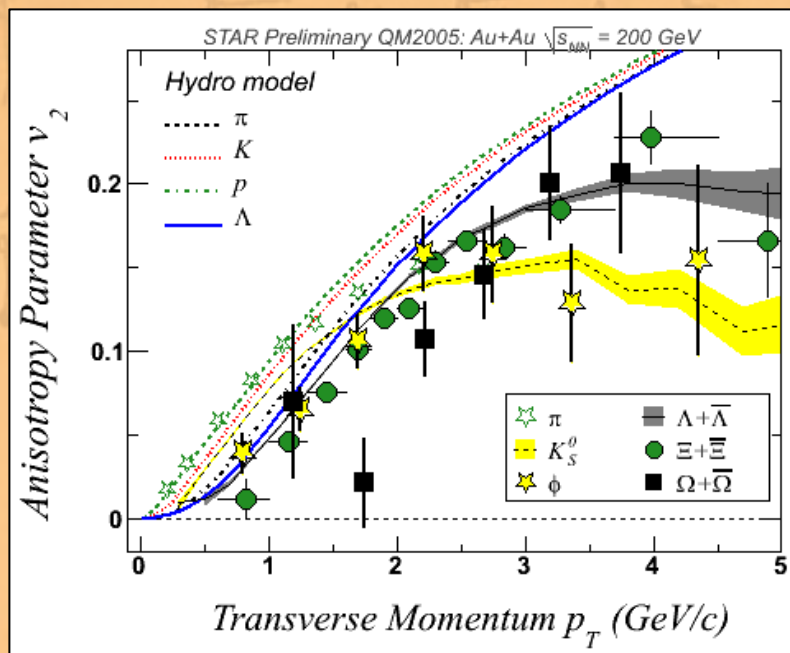
sensitivity to the **QGP EOS** & distinguish btw **hadronic & partonic** effects

Data at RCF and PDSF reduced to picoDSTs → institutes store and analyze data locally

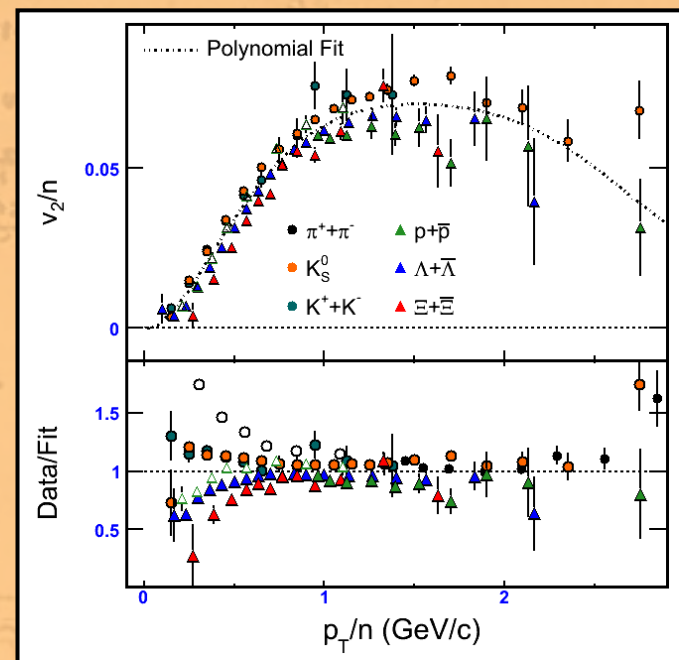
Institutes involved (so far): LBL, BNL, UCLA, IOPP, USTC, SINAP, U. of Capetown

Analysis topics: high p_T π & p v_2 , π -k-p v_2 (ToF), K_S & Λ v_2 , ϕ & K^* v_2 ,
 Ξ & Ω v_2 , p.i.d. correl., ϕ & K^* spin align., non-photonic electron v_2 ,
 Cu+Cu v_2 , $f_0(980)$ centrality dependence

why identified particle v_2



ϕ and Ω have real sensitivity to the EOS



v_2 scales with number of const. quarks: reveals sub-hadronic d.o.f.

sensitivity to the **QGP EOS** & distinguish btw **hadronic** & **partonic** effects

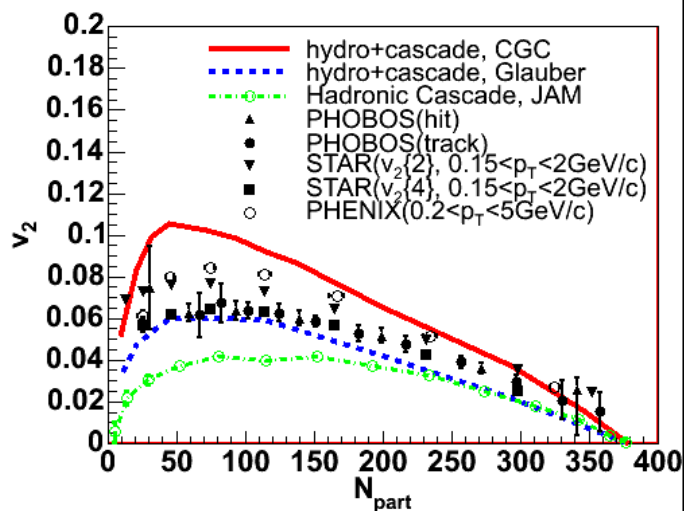
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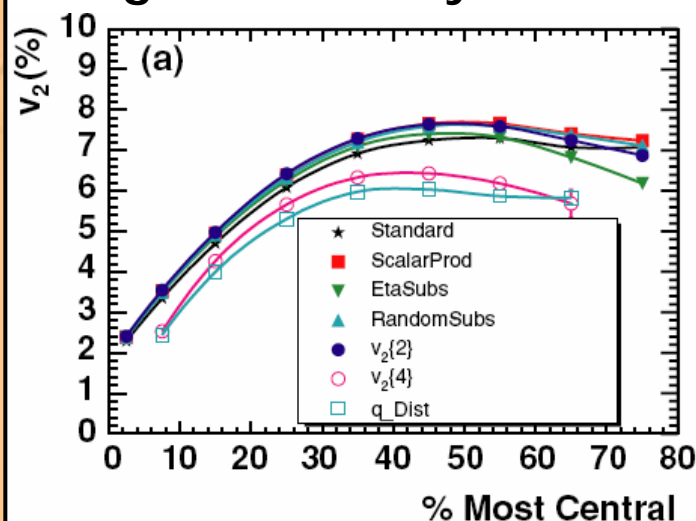
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Large model uncertainties



Large uncertainty on data



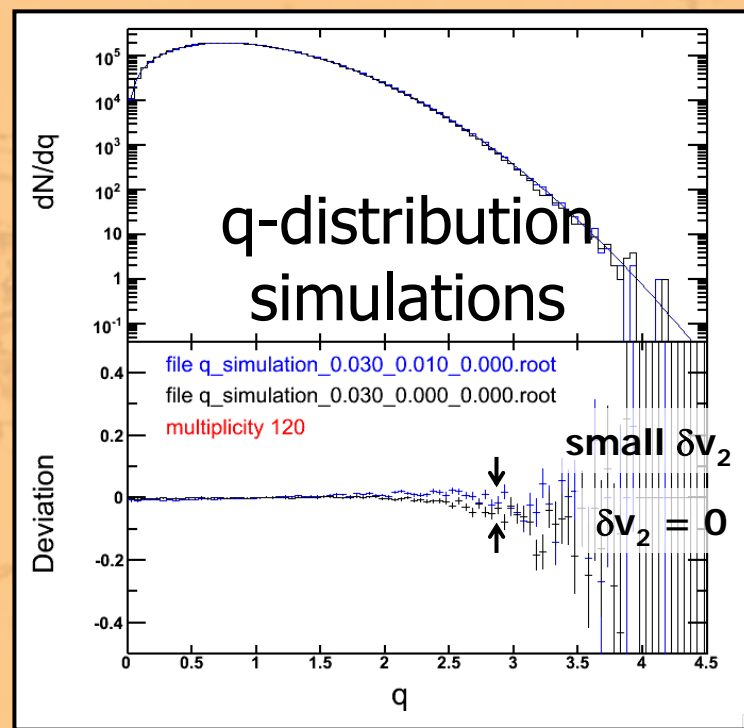
measuring v_2 fluctuations removes both uncertainties

q-distributions (simultaneous fit)

$v_2\{4\}/v_2\{6\}$ (remove non-flow)

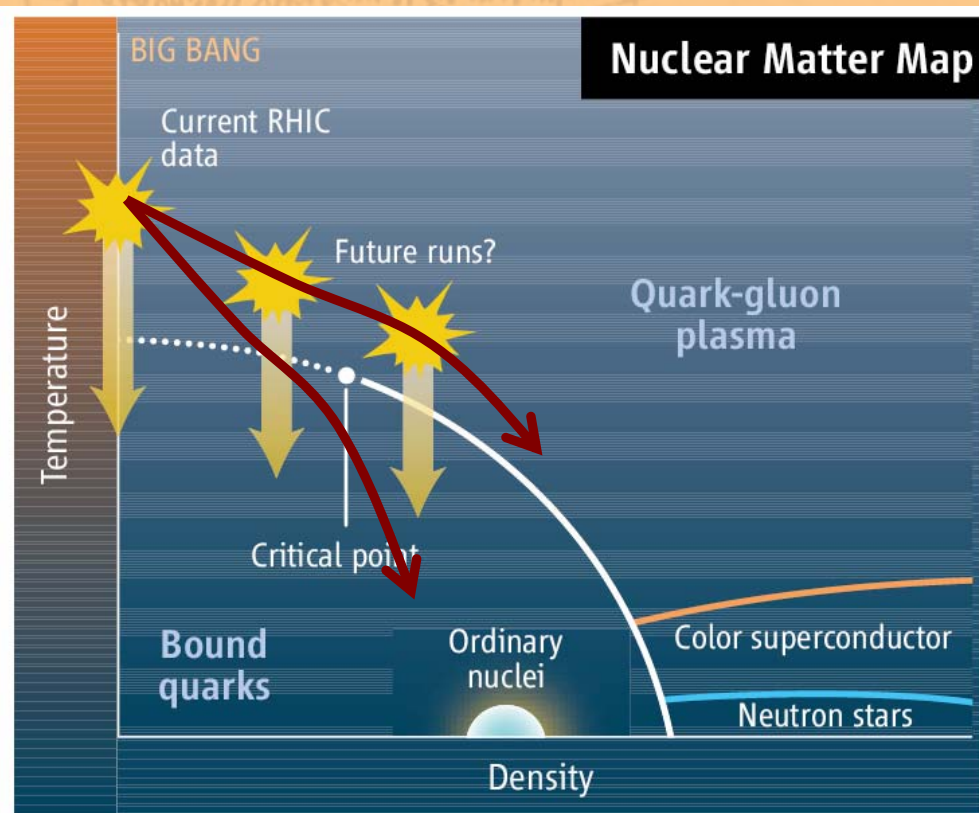
ZDC-SMD (spectator reaction-plane)

$$\frac{1}{q} \frac{dN}{dq} \propto \frac{1}{\sqrt{2\pi}\delta v \sigma_g^2} \int dv \exp\left\{-\frac{1}{2}\left(\frac{v-\langle v \rangle}{\delta v}\right)^2\right\} \exp\left\{-\frac{1}{2}\left(\frac{v\sqrt{M}-q}{\sigma_g}\right)^2\right\} \exp\left(-\frac{v\sqrt{M}q}{\sigma_g^2}\right) I_0\left(\frac{v\sqrt{M}q}{\sigma_g^2}\right)$$



constraining initial conditions

Disappearance of partonic effects or detection of critical point



Landmark study. Physicists have seen a smooth transition from bound quarks to quark-gluon plasma (dotted line). They now hope to find the point beyond which the transition becomes violent (white line).

Disappearance of partonic effects
identified particle v_2
disappearance of ncq-scaling
and multi-strange hadron v_2

Critical point discovery
detect enhanced fluctuations
and signatures of a first
order phase transition

energy scan

Understanding the matter created at RHIC

Quark and gluon degrees of freedom

- identified particle v_2 , spectra, and correlations

Constraining the initial conditions

- elliptic flow fluctuations

Disappearance of quark and gluon dof and/or critical point discovery

- high μ_B low $\sqrt{s_{NN}}$ RHIC scan

conclusion